APPENDIX B.7 UPPER WHITE SERVICE AREA
ELEMENT 1. SERVICE AREA DESCRIPTION

The Upper White Service Area (SA) is located in central Indiana and is composed of the following 8-digit HUC watershed:

- 05120201 - Upper White

The Upper White SA includes all or portions of sixteen Indiana counties listed below and is located primarily within the Central Till Plain physiographic region; the entirety of the Upper White Watershed is within Indiana.

Madison	Johnson	Hendricks
Delaware	Morgan	Boone
Randolph	Brown	Hamilton
Henry	Monroe	Tipton
Hancock	Owen	Clinton
Marion		

The Upper White SA has a drainage area of approximately 2,720 square miles within Indiana and includes over 2,180 miles of streams (Tedesco L. , et al., 2011). The majority of the SA is located in the Eastern Corn Belt Plains ecoregion and Central Till Plain natural region. The till plains are the most extremely farmed regions within the watershed consisting of generally impervious soils; these surfaces limit infiltration and promote surface runoff. The remainder of the watershed lies within the Interior Plateau ecoregion and the Highland Rim natural region; these areas tend to have poorly drained soils and are characterized by both hills and valleys in addition to a karst region in the southwestern most portion of the watershed (U.S. EPA: Ecoregions of Indiana).

Within the Upper White SA flows the West Fork of the White River and its numerous tributaries. Originating in Randolph County and traveling westward through the watershed, the West Fork of the White River passes through the state's capitol of Indianapolis. The river continues to travel southwest through Morgan County until it converges with the East Fork of the White River. From here, the White

River travels southwest until joining the Wabash River at the Indiana/Illinois state border; the Wabash River confluences with the Ohio River and eventually drains to the Mississippi River.

Based on the 2011 NLCD, the land cover type with the most area in the Upper White SA is agricultural land use (58.1%), followed by developed and impervious land use (26.4%), forest and scrub/shrub (12.8%), and wetlands and open water (1.4%) (Homer, et al., 2015). Per the NWI which accounts for more wetland acreage than the 2011 NLCD, woody wetlands are the prominent type covering 1.47% of the SA, while emergent herbaceous wetlands cover 0.26%.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Upper White SA have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Upper White SA from 2009 – 2015 was collected and analyzed **(Table 73)**. According to the data, 33.7 acres of impacted wetlands and 48,545 linear feet of impacted streams required mitigation in the seven year time period.

The development work type accounted for the most stream impacts (49.5%), followed closely by transportation and service corridors (48.5%), then energy production (1.9%), and dam and/or levee related activities (0.25%). There were no documented stream impacts requiring mitigation for agricultural activities for this time period in the SA.

Development accounted for the most wetland impacts (63.5%), followed by transportation and service corridors (34.2%), and dam and/or levee related activities (2.3%). There were no documented wetland impacts requiring mitigation for agricultural activities or energy production and mining for this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 85**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	0	0.00%	0	0.00%
Dam	120	0.25%	0.784	2.32%
Development	23,958	49.35%	21.399	63.45%
Energy Production	917	1.89%	0	0.00%
Transportation	23,550	48.51%	11.541	34.22%
Grand Total	**48,545**	**100.00%**	**33.724**	**100.00%**

Table 73. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015. Source: USACE Louisville and Detroit Districts.

Upper White Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

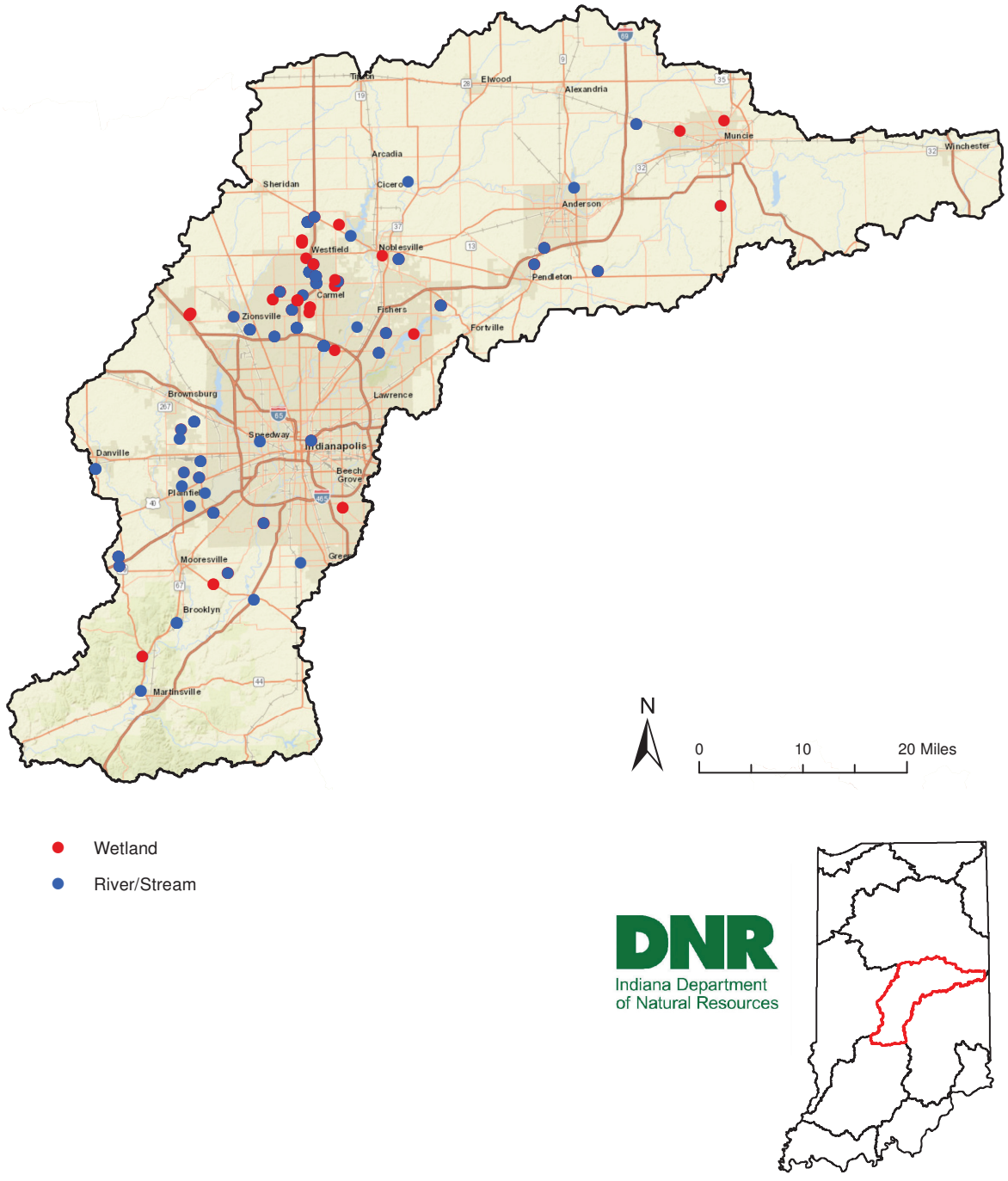

Figure 85. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015.

4.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD (Homer, et al., 2015) to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Upper White SA is presented in **Figure 86,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

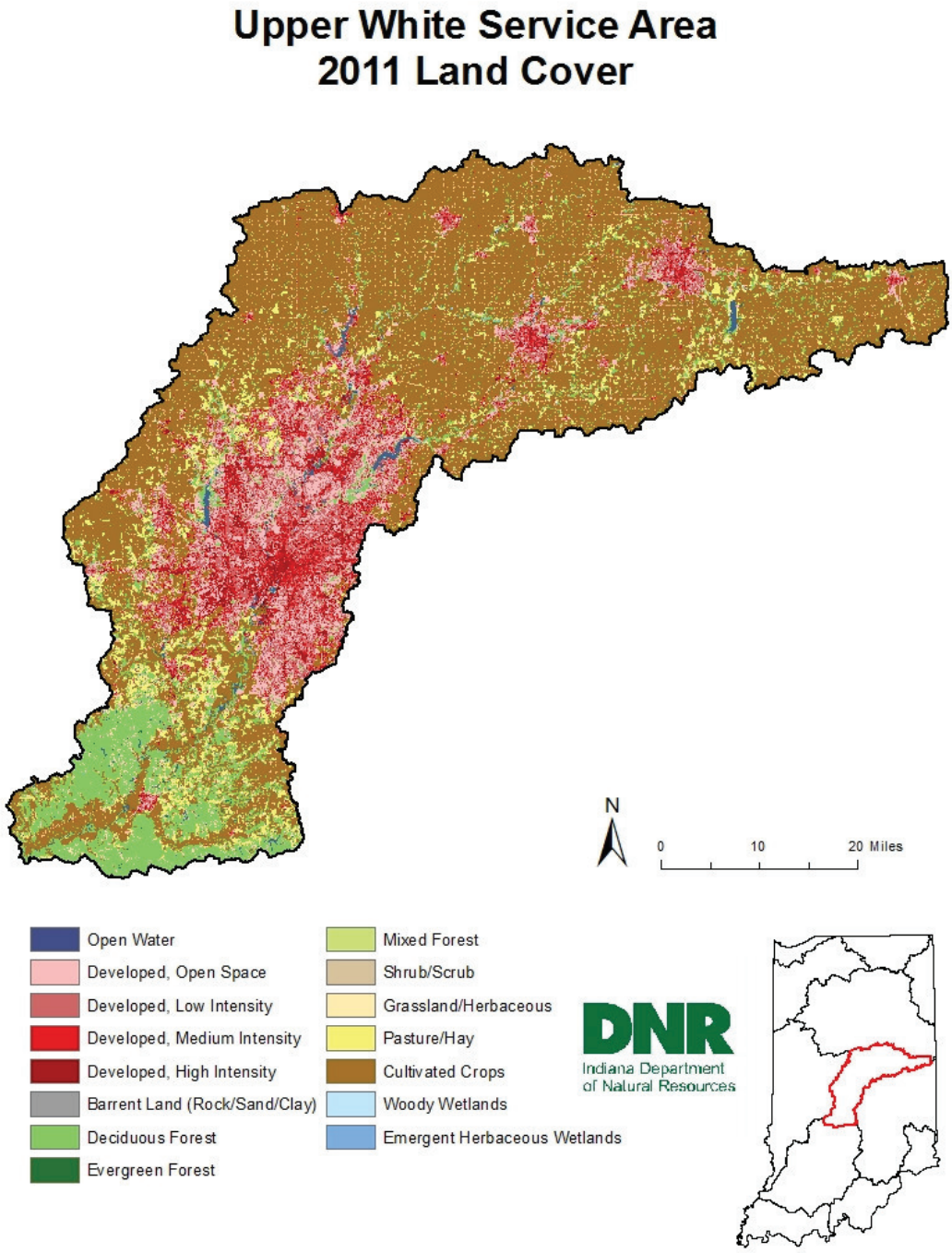

Figure 86. Land cover within the Upper White Service Area from the 2011 NLCD (Homer, et al., 2015).

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 74)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	19,211	1.10%
Developed	Open Space	198,081	11.38%
Developed	Low Intensity	158,552	9.11%
Developed	Medium Intensity	71,871	4.13%
Developed	High Intensity	31,407	1.80%
Barren Land (Rock/Sand Clay)	*	739	0.04%
Forest	Deciduous	217,013	12.47%
Forest	Evergreen	969	0.06%
Forest	Mixed	79	0.00%
Shrub/Scrub	*	4,222	0.24%
Grassland/Herbaceous	*	21,550	1.23%
Pasture/Hay (Agriculture)	*	84,524	4.86%
Cultivated Crops (Agriculture)	*	927,053	53.26%
Wetlands	Woody	2,172	0.12%
Wetlands	Emergent Herbaceous	3,189	0.18%
Grand Total		**1,740,532**	**100.00%**

Table 74. Upper White SA land cover/classification/value percentages from 2011 National Land Cover Database. * Class does not have additional values. (Homer, et al., 2015)

IDNR combined the values within the same land cover classification in **Figure 87** below to demonstrate the current overall land cover distribution of the SA.

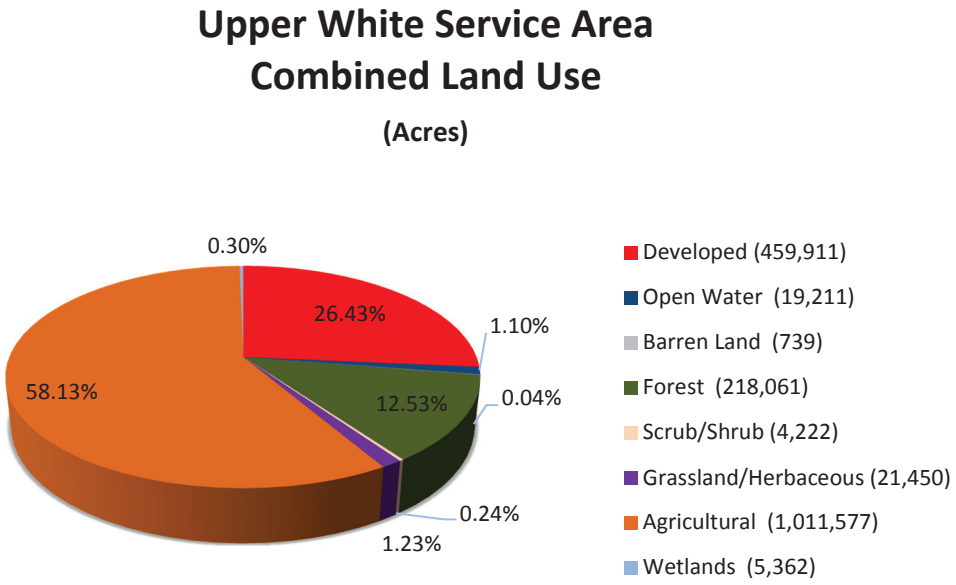

Figure 87. Combined land uses within the Upper White Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the Upper White SA. Total agricultural land use covers approximately 58 percent of the SA with a total land area of 1,011,577 acres (Fry, et al., 2011). Although the SA has a significant urban area since it includes much of the Indianapolis metropolitan area, agricultural land use is predominant throughout the northern half of the Upper White SA.

Within the identified land use areas, cultivated crops cover over 927,053 acres (53.3%) and pasture/hay lands cover 84,524 acres (4.86%) of the SA (Fry, et al., 2011). Soybean production is the primary cultivated crop, followed closely by corn, based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Upper White SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. Both dairy cattle and pig farming have active confined feeding operations (CFOs) that have a minimum of 5,000 animal units. These CFOs are considered the predominant livestock industry in the Upper White (Thompson, 2008). When combining these major agricultural land use activities, the Upper White SA ranks sixth in percentage of total statewide land use (4.37%), and it's a significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the second largest land use covering approximately 459,911 (26.4%) of the 1,740,532 total acres, the second most developed area density among SAs, though having the most developed acres of any SA accounting for 18.5% of developed land statewide, and 2% of Indiana's total area. Additionally, the Upper White SA by a large margin has the most high intensity developed area (31,407 acres) and medium intensity developed area (71,871 acres) (Table 74), combining for 103,278 acres or approximately 6% of the SA.

In general, developed impervious areas begin along the White River and Interstate 69 corridors in the north of the SA, which includes large footprint communities such as Muncie, Anderson and Pendleton. The greater Indianapolis metropolitan area then widens beginning in communities such as Noblesville, Westfield, Fishers and Carmel, and continues practically the width of the SA through Indianapolis before narrowing again along the same corridors through communities in the south of the SA such as Greenwood, Mooresville, and Martinsville. Additional communities of densely developed land use located along the SA's many interstates and highways include Zionsville, Tipton, Elwood, Sheridan, Brownsburg, Avon, Plainfield and Danville in addition to many other communities within Marion County.

The SA contains all or part of the Muncie, Indianapolis-Carmel-Anderson and Bloomington MSA's, of which all but the Muncie MSA experienced significant growth in the previous decade (Manns, 2013). The Indianapolis-Carmel-Anderson MSA is the largest in the state with a 2010 population of nearly 1.9

million. Approximately 47% (1,296,950 acres) of the Indianapolis-Carmel-Anderson MSA is within the Upper White SA which includes all or part of Madison, Hancock, Hamilton, Marion, Johnson, Brown, Boone, Hendricks and Morgan Counties, accounting for approximately 74.5% of total SA acres. This central portion of the watershed continues to undergo extensive urban expansion as agricultural areas are converted to developed lands (Tedesco L. , et al., 2011). The majority core of this MSA is the City of Indianapolis and other communities within Marion County. Approximately 87.5% of Marion County is within the Upper White SA, which account for approximately 17.5% of this MSA, and approximately 13% of total SA acres.

The Muncie MSA consists of Delaware County in the northern reach of the SA. Approximately 69% (174,776 acres) of Delaware County's 253,440 acres is within the Upper White SA accounting for approximately 10% of the total SA acres. As is common for the many large communities throughout the Upper White SA, Muncie contributes significant loads of dissolved and organic pollutants, contaminants and sediments impairing the aquatic functions and services in the upper reaches of the watershed from residential, commercial and/or industrial sources such as CSO's, impervious surfaces, storm water discharges and exposed soils (Tedesco L. , et al., 2011). Similarly, smaller rural areas upstream of Muncie contribute unsewered or failing septic waste contributing to elevated E. coli concentrations in the headwaters of the Upper White, as does the high concentrations of CFO's in Randolph County upstream of CSO related impacts (Tedesco L. , et al., 2011).

The Bloomington MSA consists of minimal areas of northern Monroe and Owen Counties in the southern downstream reach of the SA. Approximately 21,530 (4.2%) of the Bloomington MSA's 511,360 acres are located in the Upper White SA accounting for only 1.25% of total SA acres, with the remainder within the Lower White SA. Analysis of the INDOT cities and towns GIS data shows the Upper White SA contains all or part of 209 cities and/or towns, 70 of which are incorporated (INDOT, 2016).

Four Indiana regional councils that overlap the SA include the Madison County Council of Governments (MCCOG) (16%), the East Central Indiana Regional Planning District (ECIRPD) (14%), the Eastern Indiana Regional Planning Commission (EIRPC) (6%), and the North Central Indiana Regional Planning Council (NCIRPC) (5%) (IARC, 2017). The remaining counties not associated with a regional council are within the Indianapolis MSA and account for the most growth and development statewide. The Eastern Indiana Regional Planning Commission, is a relatively new regional planning district that is in the process of developing a strategic plan to guide the organization with its economic development efforts.

Additionally, analysis of INDOT's local roads GIS data (INDOT Road Inventory Section, 2016) shows there are approximately 13,253 miles of municipal and county roads contributing to the developed impervious land cover within the SA. The Upper White SA ranks second among SA's in local road miles to square mile ratio at approximately 4.87 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Upper White SA contains approximately 1,744 miles of U.S. Interstates and highways, 2,377 miles of state highways, and 17,374 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although this is the seventh largest SA, the concentration of road miles per square mile of land within the SA is substantial.

U.S. Interstates and highways have a concentration of approximately 0.64 mile per square mile, which ranks second among the eleven SAs. The concentration of state highways ranks first with 0.87 mile per square mile and is the highest ranking road type within the Upper White SA. Similar to the U.S. Interstates and highways, the ranking of the concentration of local roads falls in the top tier. The concentration of local roads is approximately 4.87 miles per square mile, which ranks it second, when compared to the ten other SAs. Similarly, the combined ranking of the concentration for all roadways, ranks near the top, with a concentration of 6.39 mile per square mile, which ranks second overall.

2.5.2 Railroads

Railroads provide an alternative means of transportation with approximately 750 miles of railroad within the Upper White SA (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Upper White SA is tied for second with the Kankakee SA for the greatest concentration of railroads with a density of 0.28 miles of railroad per square mile. The concentration of linear infrastructure throughout the SA has resulted in the loss of aquatic resource functions and services due to habitat conversion, fragmentation, and loss associated with their construction and maintenance.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Upper White SA contains service corridors contribute to aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 3,144 miles of service corridors within its boundary.

The Upper White SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately twenty-six (12 kV) lines, seventy-three (34.5 kV) lines, 192 (69 kV) lines, 237 (138 kV) lines, eighteen (230 kV) lines, seventy-two (345 kV) lines, and two (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 1,444 miles throughout the SA, which is the third highest concentration of electric transmission lines relative to the SA size, with 0.53 mile of transmission line per square mile.

In addition to electric transmission lines, the Upper White SA contains over 1,700 miles of pipelines in total. It contains over 96 miles of pipelines that convey crude oil, 1,181 miles of pipelines that transport natural gas, and 423 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Upper White SA

contains the seventh greatest concentration of crude oil pipelines, the second greatest concentration of natural gas pipelines, and the fourth greatest concentration of refined petroleum products pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 26 known low head dams (IDNR DOW, 2016) within the SA, the second most among SA's, and third most in concentration at one low head dam per 105 square miles. There are currently 104 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 26 square miles, the second highest concentration of all SA's, containing 12% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 633,600 linear feet (120 miles) of NLE's mapped within the SA, averaging one mile of NLE per 23 square miles, the fifth highest concentration among all SA's. Delaware and Tipton Counties, which fall partially within the SA, were not included in the NLE identification project since they were not declared disasters resulting from the 2008 severe weather events; therefore, the Upper White SA has additional NLE's that have not yet been mapped as part of this effort. Approximately 113 miles of the currently identified NLE's are located within rural agricultural land use, with the remaining 7 miles mapped located in developed areas.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The Upper White SA contains minimal natural gas and oil production. Although oil and gas production is minimal when compared to many of the other SA, the Upper White SA contains active oil and gas fields along with associated wells that support, or have supported, the petroleum industry within its boundary. The Indiana Geological Survey (IGS) identifies three petroleum gas fields with 102 associated gas wells; and three oil & gas fields with one oil & gas well and 25 oil wells within the boundary (Indiana Geological Survey , 2015). Conversely, there are no identified active oil fields within the Upper White SA according to the IGS dataset. Based on the identified active oil & gas fields within the SA boundary, the Upper White SA ranks tenth statewide.

The Upper White SA, also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 2,123 abandoned gas wells, 324 abandoned oil wells, 16 abandoned oil & gas wells, 28 abandoned gas storage, 19 gas storage wells, 706 dry wells, 10 stratigraphic wells, two observation wells, seven saltwater disposal wells, seven abandon saltwater injection wells, 10 temporarily abandoned wells, and 1 non-potable water supply well within the SA boundary (Indiana Geological Survey, 2015). 2.7.2 Mineral Mining and Aggregates

The Upper White SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the IGS 2016 active Indiana industrial mineral production data, the SA contains 28 sand & gravel mining operations, eight crushed stone operations, and two clay & shale operation

(Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one slag operation, which is an industry byproducts commodities that are used as aggregate (Indiana Geological Survey, 2016). Mineral mining within the Upper White SA boundary ranks fourth in the state with 39 active operations.

2.7.3 Coal

The Upper White SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Upper White SA is located mostly in the Indiana SWAP Corn Belt Planning Region (90.3%) with a small portion in the Interior Plateau Planning Region (9.7%). The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions has experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses with the agricultural and developed impervious footprints make up approximately 84.5% of the land use with the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects development, and transportation and service corridor projects to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue.

Between 2000 and 2010, The Indianapolis-Carmel-Anderson MSA experienced a 15.2% population increase, adding 231,137 people, and accounted for 57% of Indiana's population growth (Kinghorn M. , 2011). This trend is expected to continue with central Indiana accounting for as much as 70% of Indiana's projected 15% growth by 2050 (Kinghorn M. , 2011).

According to the MCCOG Anderson/Madison County 2030 Transportation Plan (2005), the areas in the vicinity of Interstate 69 exits 14 and 22 are expected to continue with significant growth that will include residential, commercial and/or industrial developments. As a result of the projected development in these areas, new transportation investments will also be necessary to improve mobility, reduce congestion, and address safety issues that can occur between highway and local road configurations (MCCOG, 2005).

Additionally, an increase in commuting patterns from Madison County and the surrounding areas to Indianapolis have impacted county roads as well as federal, state, and urban networks in the greater Indianapolis area. The increased vehicular volume and commuting trends are overwhelming local road networks that were not designed to accommodate the higher volume of traffic; therefore, road rehabilitation, upgrades and new construction will be required to improve travel (MCCOG, 2005).

As growth in eastern Hamilton County and northern Hancock County continues to move east and northward, growth is projected to continue in the western and southern portions of Madison County. Out-migration from the Anderson urban core is also contributing to growth and development of previously rural areas of the county and SA (MCCOG, 2005).

Madison County has experienced a decline over the last two decades of its two major economic sectors of manufacturing and agriculture, resulting in the focus and encouragement of development within and surrounding the municipalities to promote business revival and recruitment. Agriculture and associated agribusiness are significant economic drivers for the unincorporated areas of Madison County. Local farmers continue to produce and market crops and livestock using modern agricultural practices. There are several major food processors that operate within the region as well as mineral extraction operations within Madison County which are expected to continue and expand (MCCOG, 2005).

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Upper White SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Upper White SA's historic aquatic resources were comprised of a diverse forested natural aquatic community types that are indicative of the surrounding landscape and the White River and its tributaries. The regions aquatic and natural communities were heavily impacted due to major land-use changes enacted to facilitate early European settlement throughout the area.

The central and southern half of the SA includes the state capital of Indianapolis that was founded in 1821 based on its central location and proximity to the White River (U.S. Department of the Interior, 2017). During this period, the Indianapolis region relied upon agriculture, especially grain mills, wool mills and pork-packing plants (U.S. Department of the Interior, 2017). Similar to the rest of the SA, the southern region of the SA experienced conversion of the land for settlement and agriculture. From 1816-1853, early pioneer settlers established their homes and communities along the White River and its tributaries, clearing the land for farms and livestock (Morgan County Soil & Water Conservation District, 2005). Reports from 1883, in the "Report of Geological and Topographical Survey of Marion County", indicate Marion County's forests were reduced to small woodlots and the remainder of the land converted to cultivated fields (Brown, 1883); (Barr, et al., 2002). As the land was transformed, many of the wetlands throughout the region were drained. As large farming enterprises were established along the White River bottoms during the mid-late 1800s, marshes were being drained by ditches (Morgan County Soil & Water Conservation District, 2005). The operation of the mills and conversion of the landscape to agriculture resulted in the beginning of the degradation and loss of aquatic resources throughout the area.

Transportation was an integral factor that facilitated growth and development throughout the Upper White SA. In 1829, construction of the National Road began and it extended through Indianapolis, connecting the capital city to Richmond, IN and Terre Haute, IN connecting Indiana and to eastern and western states (The History Museum, 2017). The establishment of a major roadway that allowed travel to the northern and southern portions of the state, also compound land alterations through the region. During the 1830's Indiana constructed a north-south road that ran through Indianapolis, connecting it to Michigan City and Madison, called the Michigan Road (The History Museum, 2017). Michigan Road became the main north-south route during this time, providing a travel corridor from Lake Michigan to the Ohio River.

In addition to the influence of these roads, overland travel via railroads was an important component in the growth and development of the region. The completion of the Indianapolis & Madison Railroad within the region, along with the combining of rail firms resources to build the Union Station, provided development that the failed canal system could not (U.S. Department of the Interior, 2017). Rail also provided a catalyst for increased growth. The discovery of natural gas and railroad access to coal during the 1880's facilitated the growth of industrial foundries, machine shops, and railroad related

shops; in addition, the utilization of rail car transportation provided a connection throughout Indianapolis streets and surrounding farms by the 1890's (U.S. Department of the Interior, 2017).

Due to extensive aquatic resource loss within the Upper White SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 88** depicts each Natural Region and Section located within the Upper White SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss **(Table 75)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Central Till Plain	Bluffton Till Plain	5.95	Predominantly forested, minor areas of bog, prairie, fen, marsh and lake communities	395,828	22.74	623,822	35.84	100.00
	Tipton Till Plain	85.04	Extensive beech-maple-oak forest, northern flatwoods; bog, prairie, marsh, seep spring, and pond					
Highland Rim	Brown County Hills	7.97	Predominantly forested upland oak-hickory, mesic ravines;, acid seep spring (rare); medium to low-gradient streams					
	Mitchell Karst Plain	1.05	Predominantly forested, barrens, cave, karst sinkhole pond and swamp (southern, sinkhole), flatwoods, barrens, limestone glade and several upland forest types; medium and high-gradient streams with rocky bottoms (few surface in karst)					

Table 75. The historic natural community composition for the Upper White Service Area based upon the natural region and section

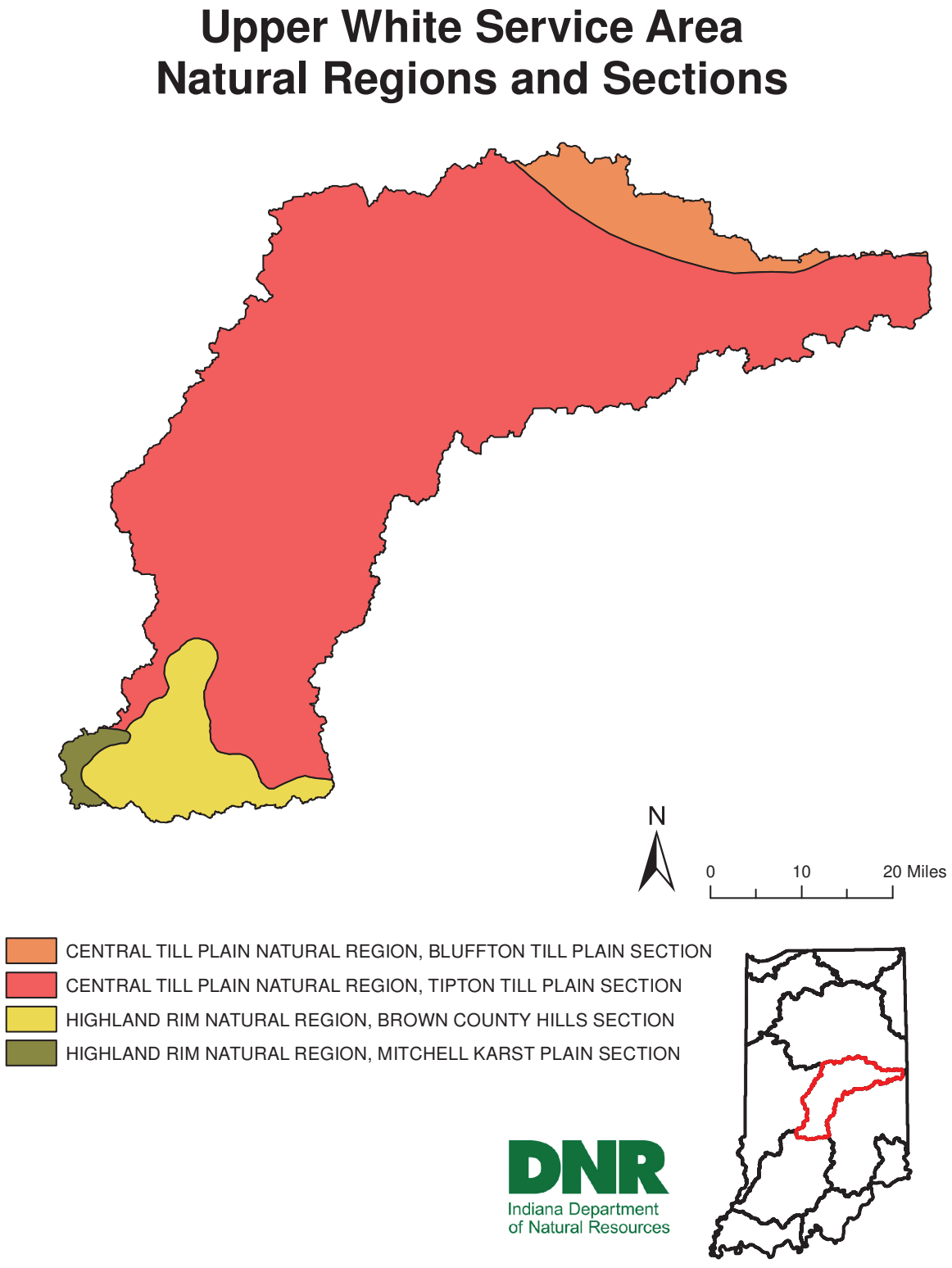

Figure 88. Natural regions and sections within the Upper White Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 1,558 miles of category 4A impaired streams and 1,622 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (2,598 miles), PCBs in fish tissue (336 miles), impaired biotic communities (158 miles), dissolved oxygen (40 miles), nutrients (36 miles), free cyanide (7 miles), and total mercury (water) (6 miles) are current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 378 QHEI assessment reaches within the SA **(Table 76 and Figure 89)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 59.79% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	76	20.11
51-64	Habitat is partially supportive of a stream's aquatic life design	110	29.10
>64	Habitat is capable of supporting a balanced warm water community	192	50.79
	Total	**378**	**100%**

Table 76. IDEM Overall QHEI scores for Upper White SA, 1991 – 2014 (IDEM OWQ, 2014)

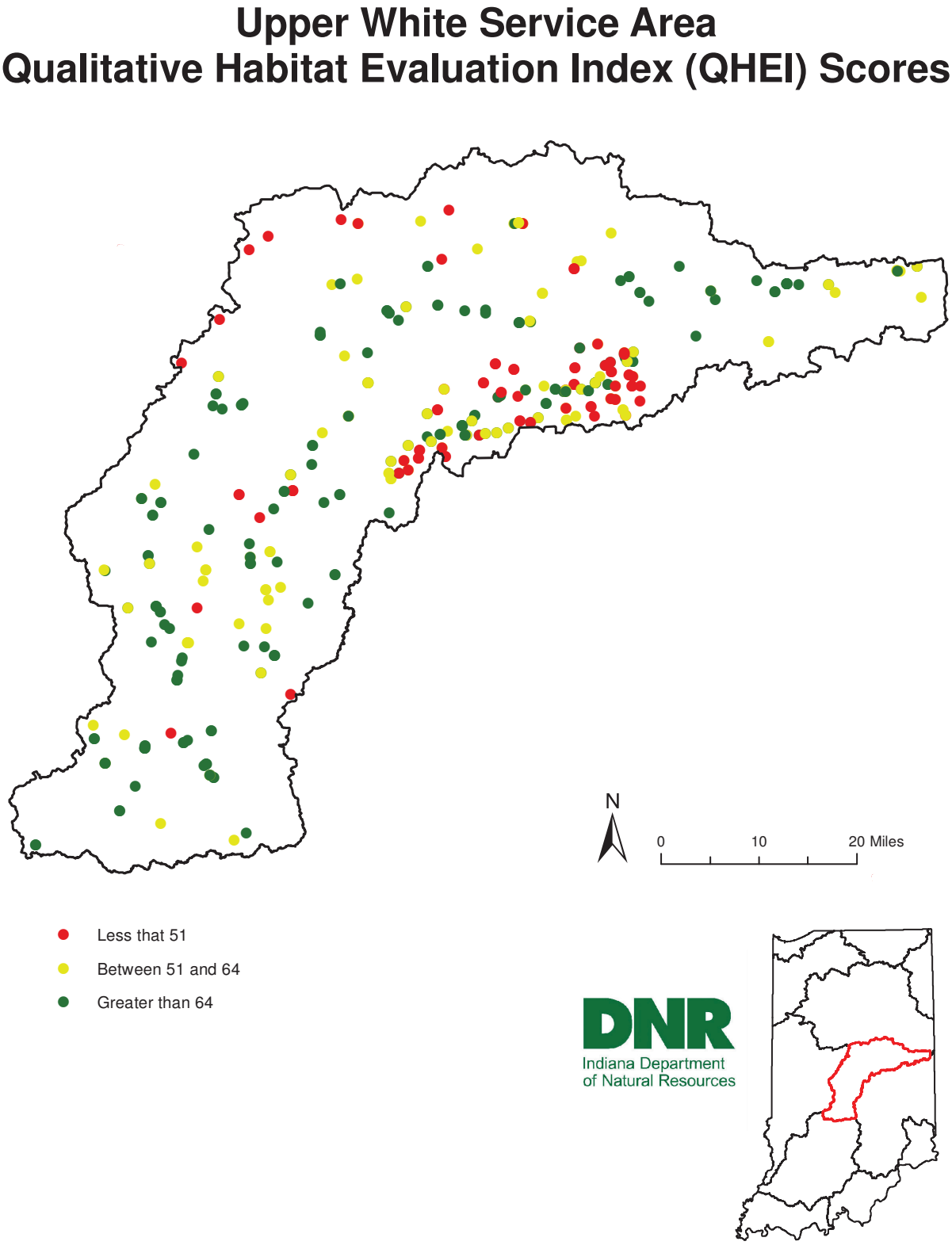

Figure 89. IDEM overall QHEI scores within the Upper White service area; 1991-2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Upper White SA ranks seventh overall in forested cover density of all SA's at 13% of total area with approximately 218,061 acres, and is the SA with the fifth smallest percentage of forested cover with approximately 4.18% of 5,215,169 acres of forest cover statewide.

GIS analysis identifies approximately 4,122,307 linear feet (781 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Upper White SA ranks 7th in ratio of these potentially restorable stream miles to square miles of SA at approximately 0.29 mile of potential restoration per one square mile, or one square mile of potential restoration for every 3.48 square miles of SA.

4.2 Wetlands

Analysis of the NWI in the Upper White SA identifies approximately 4,606 acres of freshwater emergent wetland (PEM) and approximately 25,539 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 1.73% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 5.67% of the total SA **(Table 77 and Figure 90)**. Wetland concentrations are greatest in Hamilton, Marion, and Morgan Counties.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	4,606	4.66%	0.26%	0.02%
Freshwater Forested/Shrub Wetland	25,539	25.86%	1.47%	0.11%
Freshwater Pond	13,871	14.04%	0.79%	0.06%
Lake	10,415	10.54%	0.59%	0.05%
Riverine	44,340	44.89%	2.55%	0.19%
Grand Total	**98,772**	**100.00%**	**5.67%**	**0.43%**

Table 77. Acres and percentages of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils account for 674,217 acres (**Figure 91**), or 38.7% land cover within the SA, out of which approximately 648,598 acres have the potential to be restored, accounting for 37.3% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Upper White SA has the 4th highest percentage of recoverable wetland acres to total SA size of all SA's, and the 5th most potentially restorable wetland acres of any SA. Though the Upper White SA has the most developed acres of any SA, the SA size and the dominance of agricultural land use account for the higher than average amount of potentially restorable wetland acres.

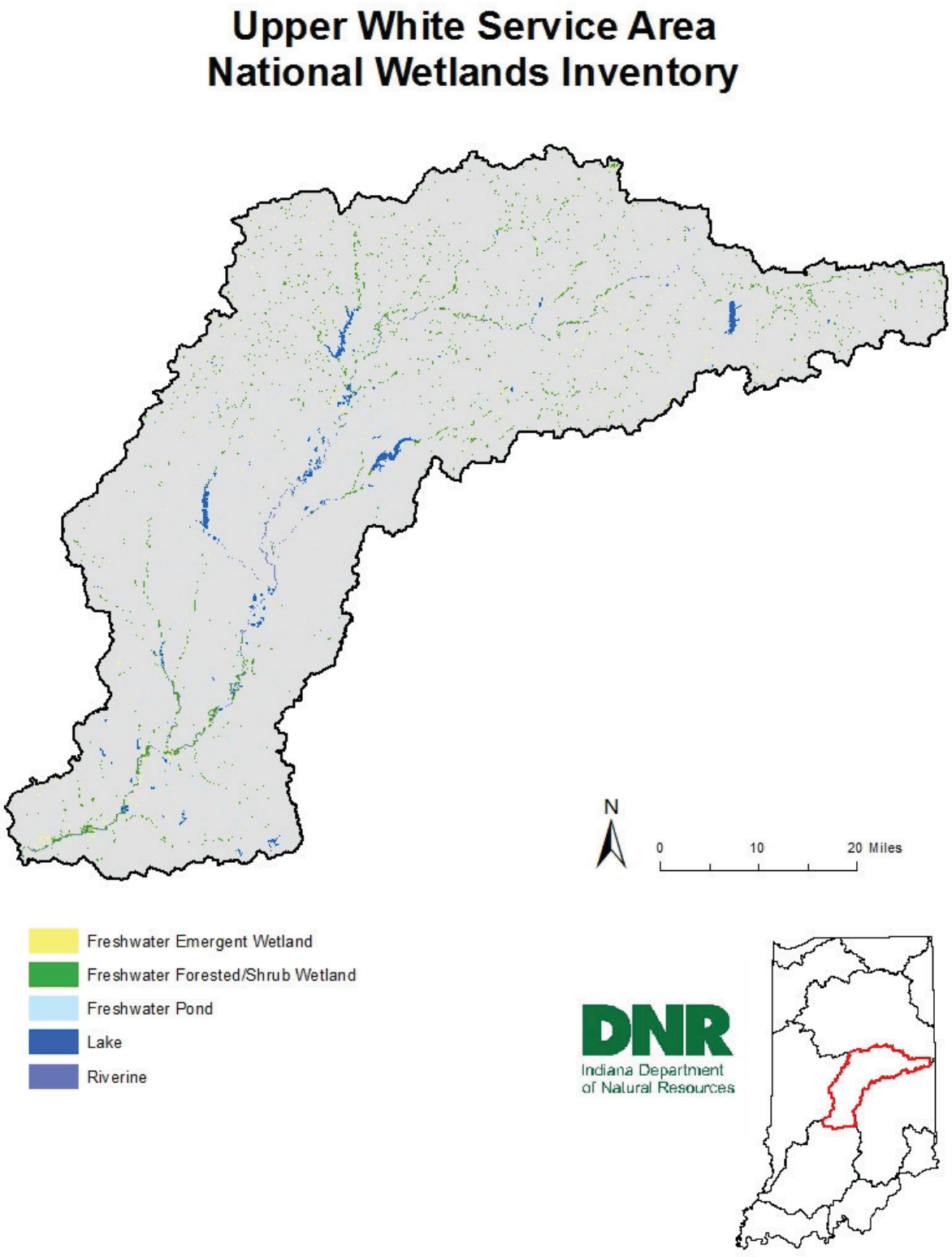

Figure 90. NWI for the Upper White Service Area (USFWS NWI, 2015)

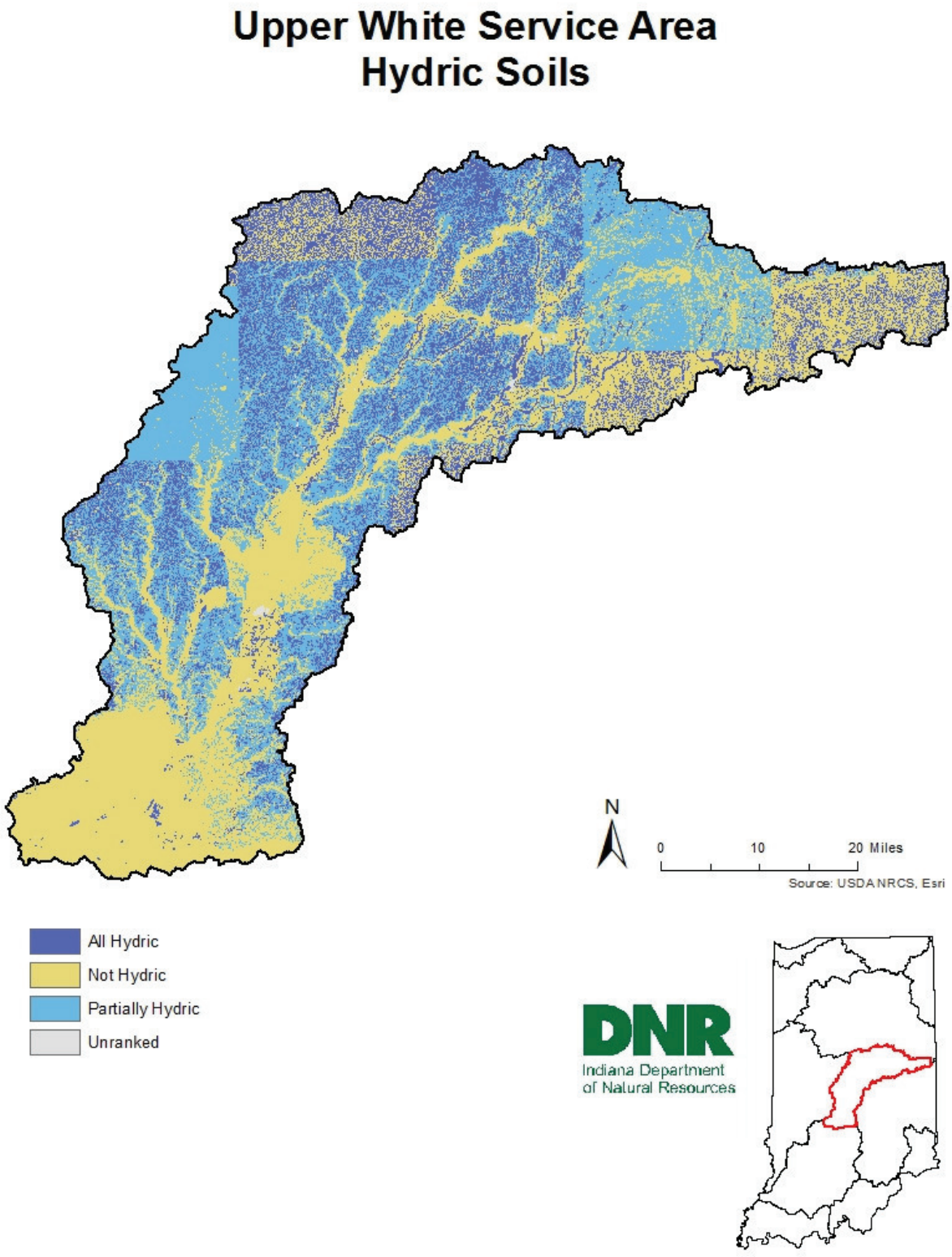

Figure 91. Hydric and partially hydric soils within the Upper White Service Area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 465,532 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Wiley Thompson Ditch-White Lick Creek (HUC 051202011302 **[Table 78]**).

Hotspots account for 1,420,320 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Little Stone Creek-Stoney Creek (HUC 051202010107 **[Table 79]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 78 & 79)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 92** shows where these watersheds are located within the SA.

Boone Pond Public Fishing Area is the only IDNR-managed land with adjacent hotspots of potentially restorable wetlands (1,433 acres).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
051202011302	Wiley Thompson Ditch-White Lick Creek	14,185
051202010405	Lilly Creek-Pipe Creek	12,310
051202010505	Lamberson Ditch-Duck Creek	12,157
051202011304	Headwaters West Fork White Lick Creek	11,661
051202011103	Finley Creek-Eagle Creek	11,343

Table 78. Watersheds in the Upper White Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
051202010107	Little Stone Creek-Stoney Creek	50,160
051202011301	Hughes Branch-West Fork White Lick Creek	49,104
051202010102	Peach Creek-White River	44,352
051202011102	Mounts Run	42,240
051202010803	Deer Creek-Fall Creek	41,712

Table 79. Watersheds in the Upper White Service Area with the most hotspots of potentially restorable streamstreams

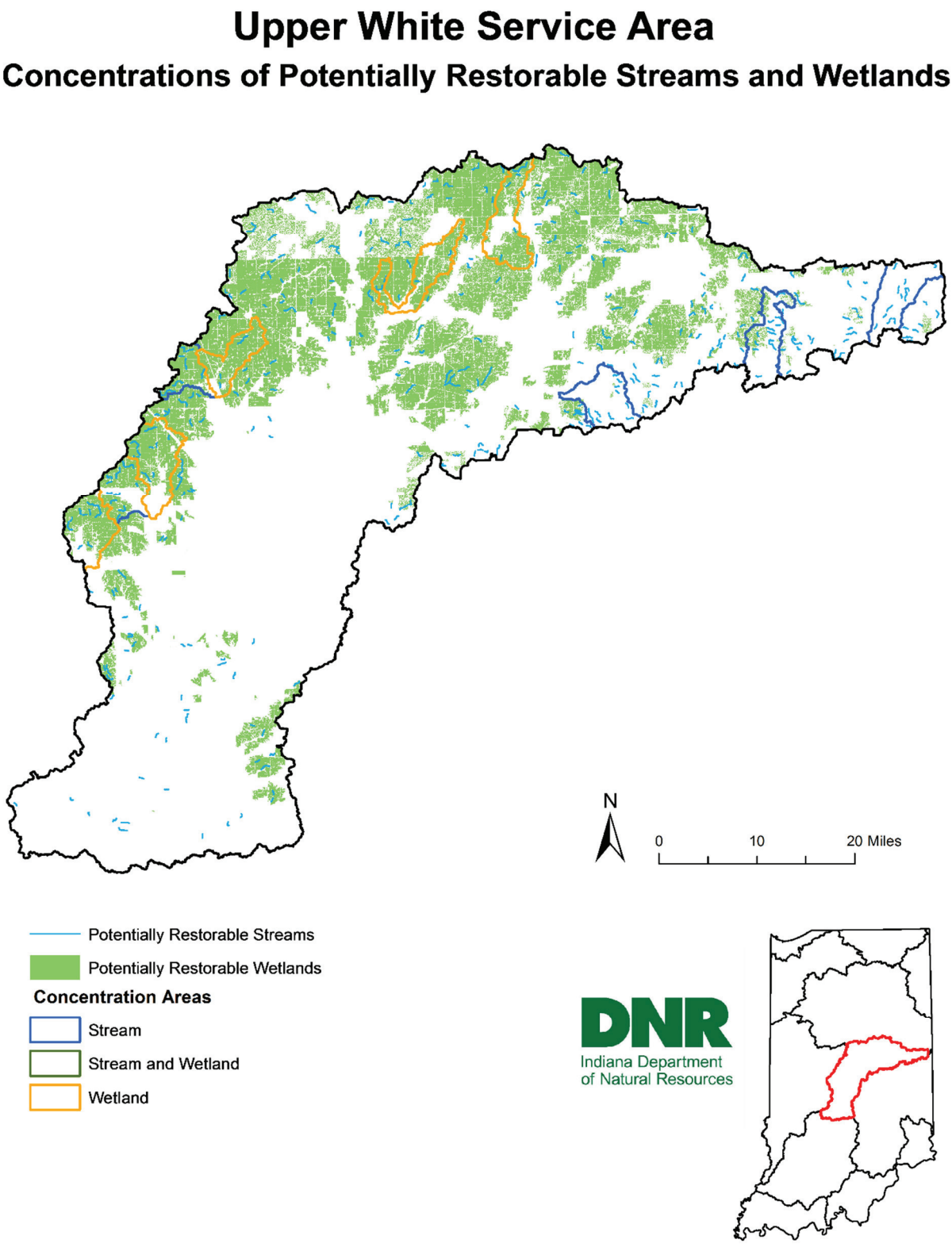

Figure 92. Concentrations of Potentially Restorable Streams and Wetlands in the Upper White Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the Upper White SA identifies three lakes currently documented with category 5 impairments, which measured using the National Hydrography Dataset (NHD), accounts for approximately 3,157 acres of PCBs in fish tissue and 1,295 acres with algae (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 19,211 acres of open water which accounts for 1.1% of the SA. This varies slightly from the NWI which identifies approximately 13,870 acres of freshwater ponds comprising of 0.8% of the SA, and 10,415 acres of lakes comprising of 0.6% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Upper White SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Upper White SA shows that approximately 98% of the shallow unconsolidated aquifers receive between 2 and 7 inches of ground water recharge annually **(Table 80).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.1	0.003%
	13	0.1	0.002%
	12	0.004	0.000%
	11	0.1	0.002%
	10	0.6	0.02%
	9	5.5	0.20%
	8	25	0.90%
	7	126	4.63%
	6	383	14.09%
	5	866	31.85%
	4	881	32.39%
	3	360	13.25%
Low	2	61	2.23%
	1	12	0.44%

Table 80. Approximate ground water recharge rates in the Upper White SA (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that nearly 100% of the Upper White SA near surface aquifers are between the low to high range for sensitivity to contamination with approximately 59% as moderate **(Table 81)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	963	0.06%
High	304,928	18%
Moderate	1,018,908	59%
Low	413,703	24%
Very Low	2,028	0.12%

Table 81. Ground water sensitivity distribution in the Upper White Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Upper White SA is sixth among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 114,859 MGD **(Figure 93)** (IDNR DOW, 2016). Energy production and mining accounts for approximately 45% of registered withdrawal capacity, followed by public water supply at 33%, industry at 21%, and agricultural irrigation, rural use and miscellaneous uses accounting for the remaining 1%.

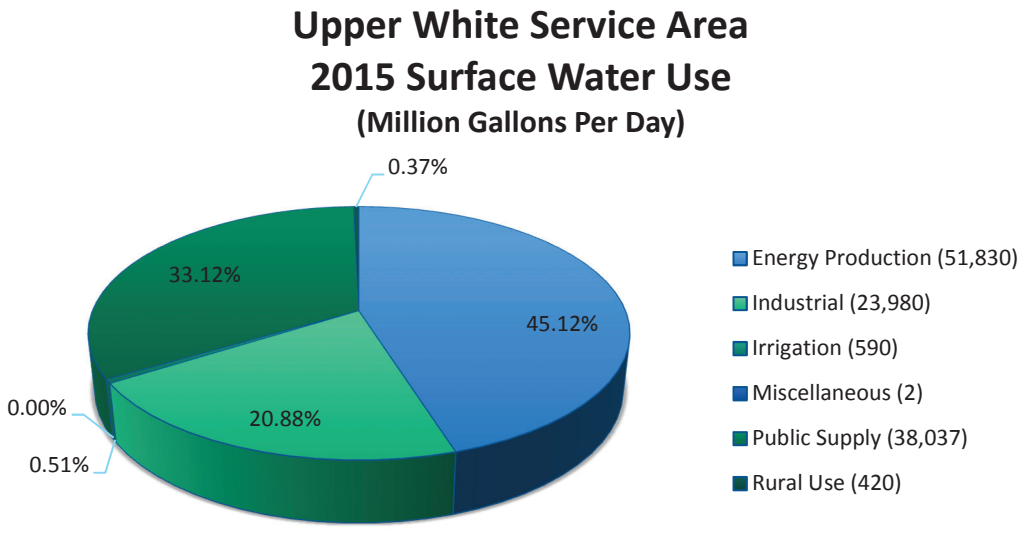

Figure 93. 2015 surface water usage in the Upper White Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Upper White SA is the most of any SA with a 41,953 MGD registered capacity **(Figure 94).** Public water supply accounts for approximately 84% of registered ground water withdrawal capacity in the SA, followed by industry with 6%, energy production and

mining with 4%, and agricultural irrigation, miscellaneous uses and rural use accounting for the remaining 6%.

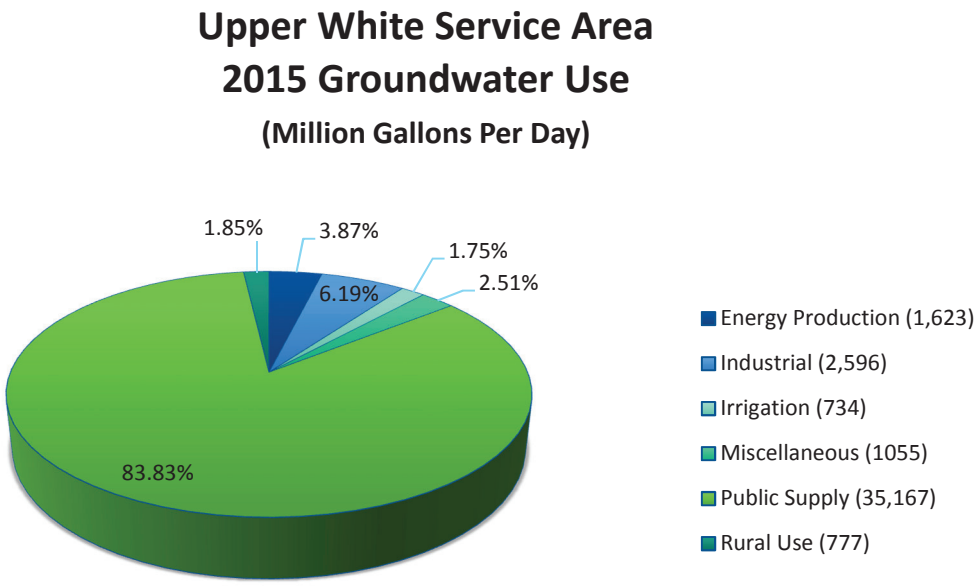

Figure 94. 2015 ground water usage in the Upper White Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Upper White SA include, but are not limited to circumneutral seep, central till plain flatwoods, fen, marsh, and wet floodplain forest, in addition to many other transitional, mixed and upland communities.

There are currently a minimum of seven amphibian species, 47 bird species, eight fish species, 17 mammal species, 15 mollusk species, and 11 reptile species listed as SGCN within the SWAP Planning Regions of the Upper White SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Upper White SA. The following aquatic resource goals and objectives apply specifically to the Upper White SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas.

1. Restoration, enhancement and preservation of aquatic resources that will help offset current and anticipated threats within the SA.

2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Target stream, riparian and wetland restoration, enhancement and/or preservation projects in urbanized areas acknowledging the challenges and constraints that will likely occur within intensely developed areas in this SA.
7. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt Plains and Interior Plateau Planning Regions where feasible.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Upper White SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Bacon Prairie Ditch WMP, Morse Reservoir/Cicero Creek WMP, Buck Creek WMP, Cool Creek WMP, Duck Creek WMP, Lilly & Little Duck Creek WMP, Eagle Creek WMP, Geist Reservoir Upper Fall Creek WMP, Indian Creek WMP, Little Cicero Creek WMP, Lower Fall Creek WMP, Lower White Lick Creek WMP, Muncie Creek-Hamilton Ditch and Truitt Ditch-White River WMP, Pleasant Run WMP, Stony Creek WMP, Swanfeld Ditch WMP, Upper White River (Delaware Co.) WMP, and WMP for the White River Watershed in North Central Morgan Co. (Lambs Creek WMP). However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Upper White SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and that provide important habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Mud-Creek Conservancy, Red-tail Conservancy, Sycamore Land Trust, and Central Indiana Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR intends to partner with land trusts that exist in the SA on compensatory mitigation projects to develop project plans and designs as well as providing long-term management and stewardship of subject properties over the life of the program.

Additional stakeholders' interest and potential conservation partnerships specific to the Upper White SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- The Upper White River Alliance, UWRWA
- Geist Fall Creek Watershed Alliance
- Morse Waterways Association
- Eagle Creek Watershed Alliance
- Friends of the White River
- Mud Creek Conservancy

- USGS Indiana Water Science Center
- Eastern Tallgrass Prairie and Big Rivers, and Appalachian Landscape Conservation Cooperatives
- Municipal and County governmental entities
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Madison County Council of Governments
- Active Watershed Groups and appropriate Watershed Management Plans
- East Central Indiana Regional Planning District
- Eastern Indiana Regional Planning Commission
- North Central Indiana Regional Planning Council
- IUPUI Center for Earth and Environmental Science (CEES)
- Mississippi River Basin Initiative

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 95** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

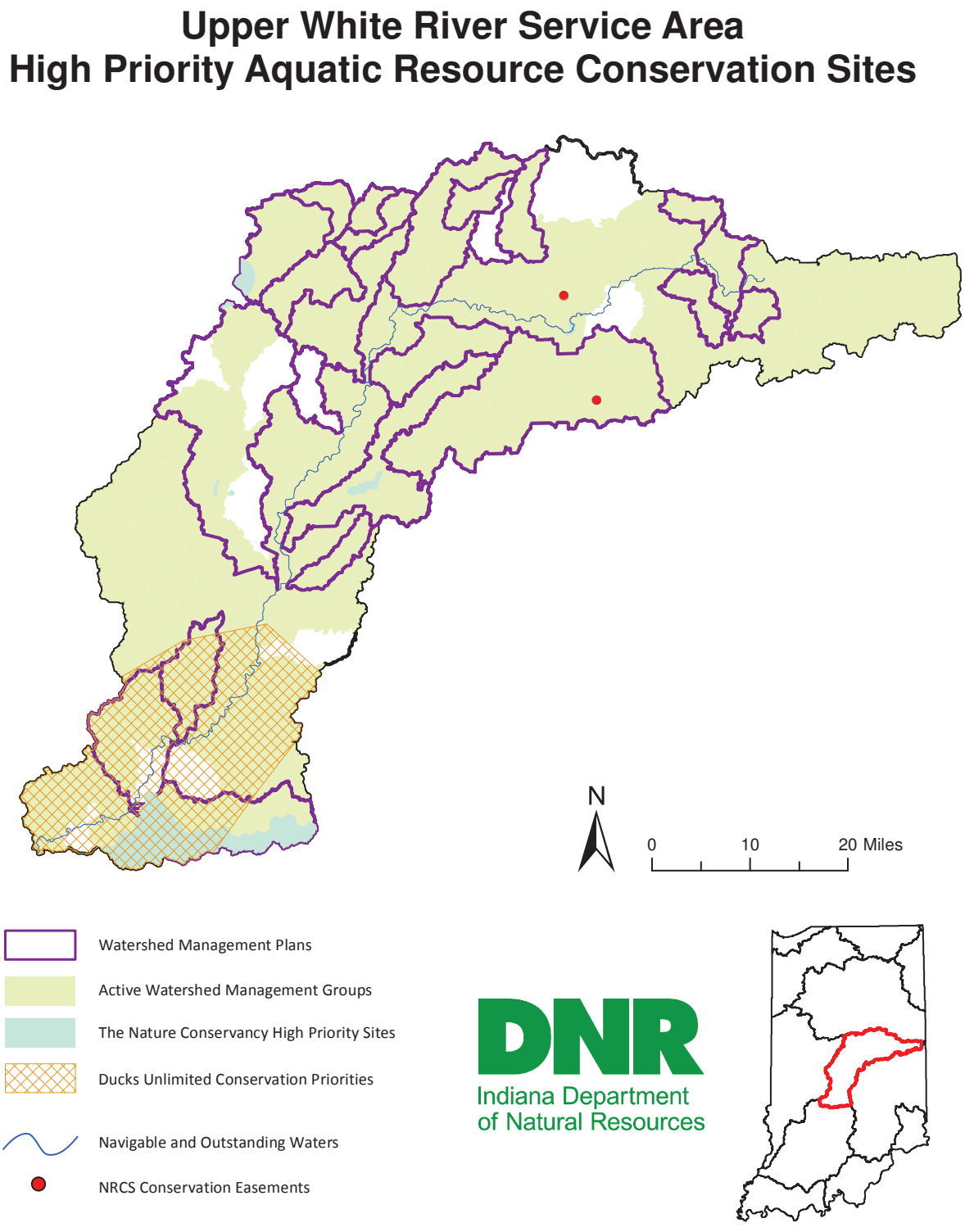

Figure 95. Priority aquatic resource conservation groups and sites within the Upper White Service Area (IWPP, 2015)